SOME SMALL NATURAL BRIDGES IN EASTERN WYOMING[1]

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Natural bridges have been described at length by Mr. Herdman F. Cleland[2] in a paper read before the Geological Society of America, December 29, 1909, and less extensively from time to time by Walcott, Cummings, Pogue, and others.[3]

Small bridges observed by D. E. Winchester and the writer, in Weston and Converse counties, Wyoming, seem to justify a brief description, as they belong to a little different class from any discussed by these writers. Of the different types enumerated the bridges in Wyoming more nearly resemble the one formed by a petrified log spanning a ravine in the petrified forest of Arizona, described by Mr. Cleland,[4] but differ from it in that they owe their existence to indurated masses or concretions instead of to a petrified log as in the case cited by Mr. Cleland.

The beds of the Fort Union and Lance formations of this district (eastern Wyoming) contain a predominance of soft sandstone and sandy shale. Almost everywhere in the sandstone are inclusions of concretions and indurated masses. They present a great variety of forms. Some are nearly perfect spheres from the size of a marble to eighteen or twenty inches in diameter; others are more irregular and vary from the shape of a log to very irregular masses sometimes several hundred feet in length. These larger

[1] Published by permission of the Director of the U.S. Geological Survey.

[2] Cleland, H. F., *Bull. Geol. Soc. Am.*, XXI (1910), pp. 313–38, pls. 18–38.

[3] Charles D. Walcott, "The Natural Bridge of Virginia," *Nat. Geog. Mag.*, V (1893), pp. 59–62; Herdman F. Cleland, "The Formation of Natural Bridges," *Am. Jour. Sci.*, 4th ser., XX (1905), pp. 119–24, 3 figs.; V. H. Barnett, "A Natural Bridge Due to Stream-Meandering," *Jour. Geol.*, XV (1908), pp. 73–75, 2 figs.; Byron, Cummings, "The Great Natural Bridges of Utah," *Nat. Geog. Mag.*, XXI (1910), pp. 157–67 Joseph E. Pogue, "The Great Rainbow Natural Bridge of Southern Utah," *Ibid.*, XXII (1911), pp. 1048–56, 6 figs.

[4] *Loc. cit.*

indurated masses when they lie in the way of a receding gulch sometimes result in natural bridges. Their origin is easily explained. As the gulch receded the water first exposed the indurated mass, then a waterfall was formed and undercutting commenced. This process soon removed the softer material until the water flowed under the harder mass and a natural bridge was formed. In Fig. 1, a loglike concretion is seen at the very head of a gulch, which has recently been undercut. The diameter of the concretion is about three feet and its length is about ten feet. In this case

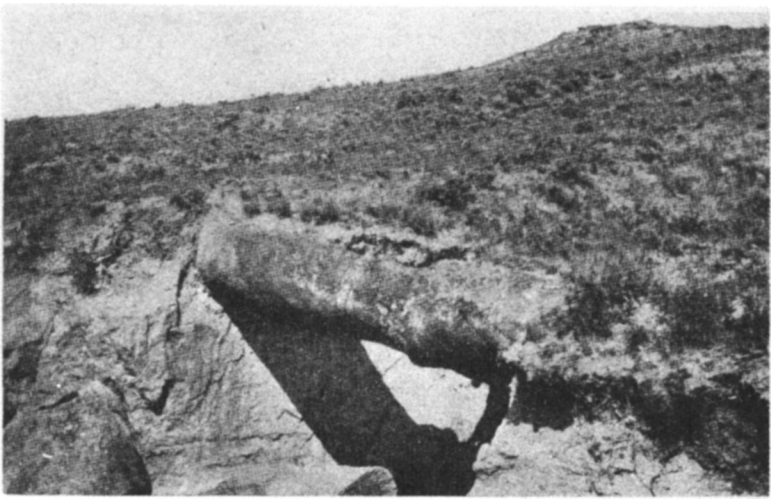

FIG. 1.—Loglike concretion occurring in friable sandstone of Lance formation about eight miles south of Moorcroft, Wyo.

one could step from the bridge to the bank at the head of the gulch.

Fig. 2 represents a bridge spanning a ravine 30 feet wide and 12 feet deep. The loglike concretion is 5 feet wide by about 3 feet thick and is quite uniform throughout its length. It is flat on top and sufficiently firm to support a saddle-horse, as shown in the picture. The third case (Fig. 3) shows an indurated sandstone mass less regular in outline than either of the others. This one was visited by Mr. Winchester who states that the bridge is about 16 feet long and 4 feet wide on top. The thickness of the indurated

mass spanning the gulch is about four feet at one end and two feet at the other. As may be seen by the illustration it is about ten feet

FIG. 2.—A natural bridge in the Lance formation at head of a gulch on the divide between Cow and Lightning creeks, Wyo.

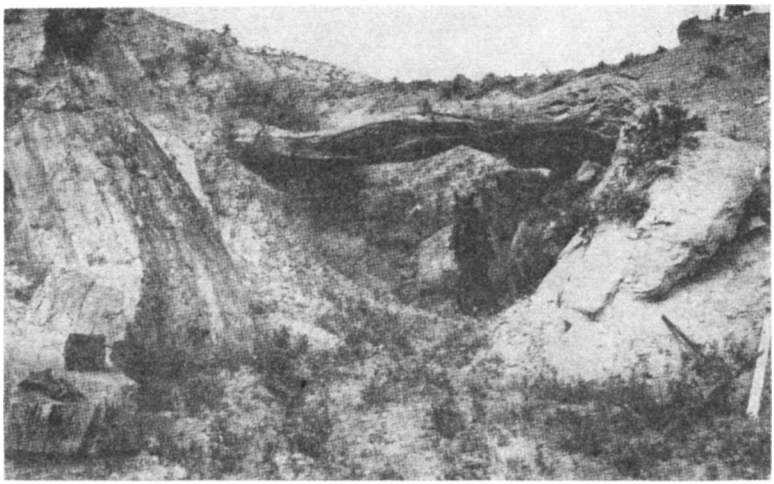

FIG. 3.—Natural bridge in the Fort Union formation about 30 miles northeast of Douglas, Wyo. (Photograph by D. E. Winchester.)

above the bottom of the gulch. This bridge is apparently more stable than either of the others cited. From the appearance of the

bed of the gulch erosion is slight at the present time, so that it will probably be a very long time before the ends of the bridge are undercut sufficiently to cause either end to tumble down.

The formation of natural bridges of this type is easily understood but the origin of the indurated masses whose existence makes the bridges possible is not so readily explained. The indurated masses appear to fall into two classes, the one taking a more or less regular and uniform outline (seen in Fig. 1) and the other a sort of irregular lense of the rock (Figs. 2 and 3). In the first case it is probable that a part of the mass has been replaced by chemical solution, while in the second case the cementing material is already contained in the mass and only requires time to become indurated. Todd[1] in describing similar occurrences in rocks of this age in South Dakota states that they probably mark ancient shore lines. It is in fact quite common to find the indurated masses at one level along an outcrop for several miles and it is not improbable that the waves of one storm, for instance, might throw together along a shore line or in a stream channel materials which would contain in themselves constituents that afterward become indurated.

Barnum Brown[2] has stated in a discussion of the "Hell Creek beds" (Lance formation) of Montana that "it is not an infrequent sight to see several parallel concretions, circular in cross-section and a hundred feet in length, like fallen trees." He says further that "they are not, however, true concretions but centers of solidification. Cross-bedding in the surrounding sandstone is frequently carried through the concretions line for line." These indurated masses are invariably darker color than the more friable surrounding sandstones. Probably they were originally about the same color as the friable material, but either percolating waters have leached the iron out of the friable sandstone or else more rapid erosion prevents oxidation.

[1] J. E. Todd, *Am. Geol.*, XVII (1896), pp. 347–49.

[2] Barnum Brown, *Am. Mus. Nat. Hist. Bull.*, XXIII (1907), pp. 829–32.